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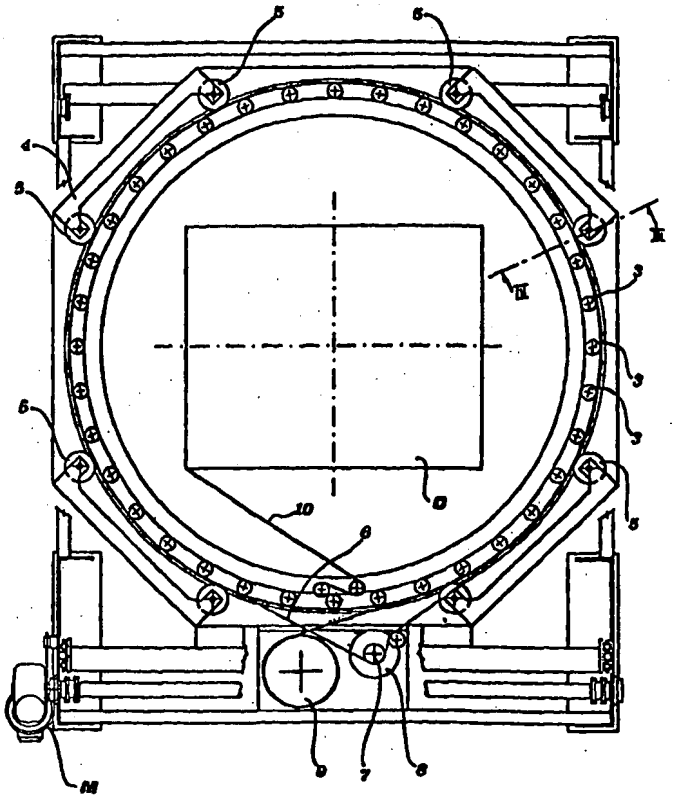
(54) Title: EPICYCLOIDAL WRAPPING MACHINE FOR PALLETS

(57) Abstract

A wrapping machine for pallets of the type comprising a fixed frame on which there is mounted a annular structure surrounding a product (C) to be wrapped and translatable with respect thereto, wherein a film of plastic material is distributed around said product by the annular structure, wherein said annular structure has a configuration in the form of an epicycloidal gearing in which the spider, the planetary gears and the driving gear consist, respectively, of an annular support, a set of rollers (3) rotatably mounted on parallel axes mounted on said annular support along a circular line, and a driving element (6) operated by motor means (7) and acting on said rollers, and wherein said film is supplied from the outside of said annular structure and, crossing said annular structure between two of its adjacent rollers, is distributed internally by the rotation of said annular structure, so as to be applied in turns on said product.



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EPICYCLOIDAL WRAPPING MACHINE FOR PALLETS

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The present invention relates to a wrapping machine for pallets. In particular it relates to a wrapping machine for pallets in which the product to be wrapped is in a fixed position and packaging is performed by means of spiral winding of an extendable film onto the product.

In the packaging or stabilization of palletized products, i.e. products piled on pallets, or for the production of multiple packs of products of various kinds (for example, little packets of coffee) grouped together in bundles, widespread use is made of pallet-wrapping machines in which a film of extendable plastic material (for example low-density linear polyethylene) is wound around the product. This type of extendable film is characterized by a notable ability for elongation and elasticity retention such that it is able to exert a retaining action on the products around which it is wound.

On the market there exist different types of pallet-wrapping machines which are affected, to a greater or lesser extent, by various drawbacks. In order to understand the innovative and revolutionary significance of the present invention, it is necessary to consider in detail the two main features of these machines: the pre-stretching capacity and the moving efficiency.

Firstly, it is necessary to consider the pre-stretching device associated with the bobbin of extendable film.

The tension of the film is approximately constant for an elongation variable from about 80% to about 300% and therefore it is preferred to stretch the film prior to winding thereof around the product, not only to provide it with the desired technical retaining characteristics, but also so as to use less material while achieving the same results. This elongation, also referred to as pre-stretching, is generally performed at the same time as unwinding of the film, by causing the latter to pass between a pair of

rubberized rollers, shortly spaced apart and having different rotational speeds: the downstream roller rotates faster than the upstream roller, causing elongation of the film. The short distance between the two rollers has the purpose of preventing transverse contraction of the extendable film, a contraction which would not allow the desired pre-stretching in the longitudinal direction.

The pre-stretching unit, over time, has assumed different forms and characteristics with a view to constantly improving its performance and overcoming the intrinsic problems associated with operation thereof.

In fact, the pre-stretching unit must not only simply release the stretched film, causing it to unwind from the bobbin, but must be able to ensure that the operating parameters, such as the feed speed and the tension imparted to the film, remain as constant as possible despite the fact that the winding conditions vary with a certain regularity. The point where the film is released, from the pre-stetching device, for example, follows trajectory which is substantially circular - by means of moving systems which will be discussed further below - whereas the product does not necessarily have a cylindrical shape with an axis coinciding with the axis of the circular trajectory; on the contrary, in most cases, it has a parallelepiped or in any case irregular shape. This means that the distance between the point where the film is released and the point where it adheres to the product varies with a certain regularity, which gives rise to fluctuations in the tension and feed speed of the film. Moreover, it should be possible to regulate the release tension, as well as the tension imparted to the film during pre-stretching, in accordance with the specific requirements.

According to the known art, various solutions have been proposed both in order to regulate the speed and the feed tension according to the surrounding conditions, and so as to be able to regulate the degree of pre-stretching.

The most simple and economical solution adopted generally consists in connecting the two rubberized idle rollers by means of a pair of fixed gears of different diameter. In this way the speed ratio between the two rollers - and hence the pre-stretching tension - remains constant and the film is unwound from the bobbin, causing rotation also of the rubberized rollers, owing to the tension imputed to the film and which is generated as a result of the relative movement between bobbin of reel and product. This solution may be acceptable in those cases where a relatively high degree of tensioning of the film is tolerated - it is suitable, therefore, where the product to be packaged is stable, as in the case of a pile of bricks, but not so when the products are deformable, as in the case of cardboard boxes, since the latter would be irremediably crushed at their edges - and, above all, when operation is performed with low tension of the film, which film is thus not affected by variations due to the irregular shape of the product.

In order to overcome these drawbacks, the most advanced wrapping machines for pallets use a motorized pre-stretching unit in which at least one of the two rollers is motor-driven and the speed of rotation of the pre-stretching unit, and indirectly the feed speed of the film, are regulated on the basis of the tension detected on the film downstream of the pre-stretching unit. Normally the tension of the film is detected by means of a so-called "jockey roller" consisting of a roller which is mounted on the end of an oscillating arm and over which the film travels: the tension of the film causes the arm of the jockey roller to oscillate, activating electric systems which emit a regulating signal for driving the pre-stretching unit. This system, in addition to being somewhat complex, suffers from a notable intrinsic response inertia which necessarily limits the working speed of the pallet wrapping machine. In fact, when operating at high speeds, there is the risk of a delay in the response of the system compared to that required, resulting in counter-productive effects. To avoid adversely

affecting the reliability of the machine, the operating tension must be necessarily kept low, otherwise sudden variations in tension may cause breakage of the film.

In the cases where, moreover, the degree of pre-stretching must also be regulated, the rubberized rollers may be driven independently, or use may be made of a motor-driven roller coupled with a braked one, and so on.

All these systems, as has been seen, are complex and, for one reason or another, are never entirely satisfactory.

Secondly, it is necessary to consider the system for the relative movement between the palletized product and the bobbin with its pre-stretching unit.

The wrapping machines for pallets used hitherto in the art consist substantially of two constructional types: one type where the bobbin of extendable material and the pre-stretching unit are mounted so as to slide vertically on a column and the product is made to rotate on a rotating platform, and another type where the product is fixed and the bobbin with the pre-stretching unit are made to rotate in a spiral path around the product to be packaged. The second type is specially designed for high productivity and is the one to which the invention refers.

In order to provide the spiral path around the product, the bobbin and the pre-stretching unit are mounted on a support bracket which describes a circular trajectory as it moves along the axis of the spiral. This movement is obtained substantially by two methods: by means of a rotating arm, hinged on a vertical axis at the top of the product, or by means of a rotating ring, surrounding the product, both moving vertically on suitable guides formed, normally, on a bridge frame which embraces the transportation line on which the palletized products travel.

Both these solutions have serious drawbacks.

Firstly, the bobbin and the pre-stretching unit mounted on the

support bracket constitute a not insignificant mass, of the order of 70-80 kg, which shall be made to rotate along a circular trajectory with a wide radius (for palletized products, a minimum diameter of about 2 m is required) and with an angular speed of about one revolution per second, thus generating considerable centrifugal forces. These considerations are particularly important in the case of machines with a rotating arm where the arm must be provided with an additional balancing mass.

All this results in weighing down of the support structure, which must be dimensioned so as to withstand mainly the centrifugal forces (compared to these letters, the forces due to the wrapping tension become negligible), and in serious complications in view of the accident prevention measures which are to be adopted. In fact, a mass of 70-80 kg which moves at a speed of about 6 m/sec. possesses a considerable amount of kinetic energy, which is fairly dangerous should it accidentally come into contact with an object or a person or, even worse, should the support structure collapse. It is in particular for this reason that the winding speed, and hence the productivity of conventional wrapping machines for pallets, normally does not exceed the values mentioned above.

Secondly, in the case of use of a motorized pre-stretching unit, the motor for the driving system must be necessarily mounted together with the pre-stretching unit on the support bracket. This involves the transfer of power, an electric power for the most part of the cases of electric power, from a fixed installation to the motor in movement along a circular trajectory. The power supply line will therefore make use of sliding contacts or other known systems, but will nevertheless be complex and costly.

Finally, the replacement of the bobbin always involves stoppage of the machine with access by the operator inside the working zone of the pallet wrapping machine. This operation, in addition to involving a not small amount of dead time and requiring suitable safety measures, also

results in other indirect disadvantages.

In particular, the bobbin may run out at a time when the operator is involved in other operations and therefore the machine downtime will also be determined by the time necessary for the operator to realize that replacement is required and to interrupt the operation which he was already performing. Moreover, on some occasions, the bobbin runs out without having completely enveloped a product: in this case the operator is obliged to eliminate the portion of film already wound on the product and recommence the packaging of that product so as to avoid the same remaining slack or incomplete.

It has become generally widespread practice for an expert operator, as a way of overcoming these drawbacks, to interrupt operation of the machine of his own initiative, at a moment when he has some free time available, in particular when the bobbin is not yet entirely used up, but there is no longer a sufficient quantity of film to package entirely a new product; this operation enables excessive dead time owing to machine stoppage to be eliminated, but results in wastage of material which is no longer recovered.

The object of the present invention is therefore that of eliminating entirely all the drawbacks mentioned above and, in particular, of providing a machine which is able to wrap a product, resting on the pallet in a fixed position, with an extendable film, by stretching the film itself, during feeding thereof, in a constant and uniform manner and without making use of complicated mechanisms for adjusting the tension; preferred embodiment, this machine must also allow elimination of the dead time resulting from machine stoppage and facilitate maintenance work by the operator; a final object is that of achieving the aforementioned features with a machine which is both streamlined and lightweight and which thus allows a reduction in the manufacturing and rigging costs.

These objects are achieved with a wrapping machine for pallets of

the type comprising a fixed frame on which there is mounted an annular structure surrounding a product to be wrapped and translatable with respect thereto, wherein a film of plastic material is distributed around said product by the annular structure, wherein said annular structure has a configuration in the form of an epicycloidal gearing in which the spider, the planetary gears and the driving gear consist, respectively, of an annular support, a set of rollers rotatably mounted on parallel axes mounted on said annular support along a circular line, and a driving element operated by motor means and acting on said rollers, and wherein said film is supplied from the outside of said annular structure and, crossing said annular structure between two of its adjacent rollers, is distributed internally by the rotation of said annular structure, so as to be applied in turns on said product.

Further characteristic features and advantages of the machine according to the invention will be apparent, however, more clearly from the detailed description which follows of a preferred embodiment thereof, provided by way of example and illustrated in the accompanying drawings in which:

Fig. 1 is a side elevation view, with parts removed, of a wrapping machine for pallets according to the invention;

Fig. 2 is a top plan view of the wrapping machine for pallets according to the invention;

Fig. 3 is a view, on a larger scale, of a partial section along the line III-III of Fig. 2;

Fig. 4 is a view, on a larger scale, of the details shown enclosed by the circle B in Fig. 1;

Fig. 5 is a plan view, on a larger scale, of the driving system and the pre-stretching unit according to a preferred embodiment of the invention;

Fig. 6 is a view, similar to that of Fig. 2, of another embodiment of the invention; and

Fig. 7 is a view, similar to that of Fig. 4, of the embodiment shown in Fig. 6.

As can be seen in Fig. 1, a bridge frame P, of a known type, is located across a transportation line T, at the position for packaging towards which a product C, resting on a pallet, moves. According to the invention, the machine which actually performs wrapping with the extendable film consists of a ring structure N (which can be seen in Fig. 1 in the raised position) mounted so as to slide vertically on the bridge frame P and raised and lowered by means of a raising system operated by a motor M.

The annular structure N consists of a pair of annular rims - a lower one 1 and upper one 2 - which are fixed together by a set of pins arranged along an ideal circular line, on which there rotate rollers 3 mounted idle between said rims 1 and 2 which thus form an annular support for said rollers. The two rims 1 and 2 are guided on a guiding frame 4 so that they are free to rotate in their plane. Preferably, the guiding frame 4 comprises a set of wheels 5, in particular eight wheels 5 (Fig. 3), which are arranged uniformly along the perimeter of the rims 1 and 2 and on which the annular structure N is supported, being free to rotate.

An endless belt 6 extends over the rollers 3, on the outside thereof, embracing the entire set of rollers 3 as shown in Fig. 3, and also traveling over a driving pulley 7 of a power motor 8 (Figs. 4 and 5) arranged on the outside of the annular structure N. The movement of the belt 6 operated by the motor 8, being transferred to the periphery of the rollers, causes rotation of the rollers 3 about themselves and/or the rims 1 and 2, which form a single body with the rollers, around the centre of the circular structure N, depending on which of the two offers least resistance. If, in fact, rotation of the rims supported on the wheels 5 offers a greater resistance, the belt 6 will preferably cause rotation of the rollers 3 and vice versa.

In other words, an epicycloidal transmission system is provided, in which the planetary gears are the rollers 3, the spider consists of the combined arrangement of the two rims 1 and 2, and the belt 6 forms the driving gear; the movement of the belt 6 is transmitted to the rollers 3 and to the rims 1 and 2 by suitably adjusting the resistance to the movement offered by them: should, for example, the two rims 1 and 2 be stopped, the movement of the belt would be converted totally into a rotation of the rollers 3 about their axes and, vice versa, if rotation of the rollers 3 were blocked, the movement of the belt 6 would produce rotational driving of the two rims 1 and 2 together with the rollers fixed thereto.

Normally the internal friction is such that rotation of the entire annular structure N is privileged over rotation of the individual rollers. Therefore, by suitably adjusting a braking system (not shown) operating over the rims 1 and 2, it is possible to obtain an intermediate movement, i.e. a partial rotation of the rims and partial rotation of the rollers about themselves.

One of the rollers 3 - the roller 3a - is rubberized and is coupled with a corresponding rubberized roller 3b, arranged at a short distance from the roller 3a and further internally with respect to the ideal circular line described by the set of rollers (Fig. 5). These two rollers 3a and 3b form a pre-stretching unit, which was discussed in detail above, having a well known configuration. Preferably, for the sake of greater simplicity and economy, they are connected by means of a gear-type coupling arrangement which provides a transmission ratio such that the roller 3b rotates at a greater speed than the roller 3a.

A bobbin 9 of extendable plastic film is mounted, externally with respect to the ring structure N, on a suitable support (not shown) which allows free rotation thereof.

Operation of the wrapping machine for pallets according to the invention will now be described so as to clarify even further additional

characteristic features and details of the machine.

Initially an end of the film 10 is passed onto the roller 3a and then, in the opposite direction of rotation, onto the roller 3b as well, and, by means of a transmission roller 11, is guided finally, with automatic gripper systems of the known type, which we shall not consider here, onto the product to be wrapped. The film 10 does not interfere with the belt 6 since the latter adheres to a upper portion of the rollers 3 (as can be clearly seen in Fig. 4), whereas the film adheres to the remaining portion thereof.

When the motor 8 is started up, the belt 6 causes rotation of the annular structure N which, in turn, causes rotation, about the product C, of the point where the extendable film 10 is released - which corresponds to the position of the transmission roller 11 - performing the desired winding action. The spiral path of the point where the film adheres onto the product C, is obtained by combining the rotary movement of the annular structure N with vertical translation thereof on the bridge frame P.

Actually, what happens is somewhat more complex: let us analyse the situation.

First of all, as the film is gradually distributed onto the product C, passing across the pre-stretching unit consisting of the two rollers 3a and 3b, it undergoes the desired elongation.

Secondly, the epicycloidal system described has a fairly important characteristic feature, namely it constitutes a superb self-adjusting mechanism for the feeding tension of the film 10. In fact, let us suppose that, on account of the irregularity of the shape of the product C, at a certain time the feeding of a greater quantity of film is required, resulting in an increase in the tension exerted thereon. The increase in tension immediately produces an equal and opposite reaction on the transmission roller 11 and on the pre-stretching unit, resulting in a braking action on the annular structure N. This leads to a slowing down in the rotation of the

annular structure N (spider) and in a corresponding increase in the speed of rotation of the rollers 3 (planetary gears), in particular the roller 3a which determines the feed speed of the film 10 and which, therefore, we shall also call feed roller 3a. The combined action of acceleration of the pre-stretching unit and slowing down of rotation of the annular structure, and hence also of the point where the film is released, corresponding to the roller 11, favours a reduction in the tension of the film and therefore re-establishes instantaneously, owing to the lack of delays in the system, a new equilibrium condition. This equilibrium condition is typical of the particular working condition of the epicycloidal system, in particular the internal friction of the system and speed of the belt 6, and therefore may be regulated, for example, by suitably adjusting the braking system mentioned above. The ideal braking condition is the one where, with practically zero tension, i.e. where no film is required, there is also no feeding of the film, namely rotation of the annular structure occurs exclusively without rotation of the rollers.

The rapid succession of these equilibrium conditions allows operation to be carried out always with a substantially constant tension of the film 10, without having to adopt complicated automatic adjusting systems, such as the jockey roller of the known art.

Another fairly interesting aspect of the wrapping machine for pallets according to the invention consists in the fact that, since the bobbin is mounted externally of the annular structure, it unwinds the film both onto the product C and onto the perimeter of the annular structure itself.

In fact, during a complete revolution of the annular structure N, one turn of film is envelopped on the product C and, at the same time, is distributed also onto the annular structure N, thus unwinding a quantity of film far greater than that strictly necessary for packaging of the product C.

Ideally, if the film were not extendable and the perimeter of the product C were equal to the circumference of the annular structure N, at

each turn a quantity of film exactly double that required would be unwound. In reality, the intense pre-stretching which the film undergoes before being wound onto the product and the size of the latter, which never is as great as that of the perimeter of the annular structure N, is such that the film fed to the product is only a small amount of that actually unwound from the bobbin 9.

This excess of film unwound from the bobbin 9, accumulates, ringwise, in the form of a strip 10a adhering to the outside of the rollers 3. During operation, the feed roller 3a draws the film from the innermost ring of the strip 10a, while the bobbin supplies the outermost ring of the strip 10a. It is obvious that the strip 10a, resting on the rollers 3 and having to unwind an amount of film equal to that required for packaging will have a peripheral speed, relative to the rims 1 and 2, equal to the peripheral speed of the rollers 3, i.e. equal to the feed speed of the film.

Using a bobbin of extendable film, commonly used in this sector, the maximum thickness which the strip 10a may assume is 10 mm, which, for a diameter of 2 m typical of the annular structure N, means a variation in length of 1% between the innermost ring and the outermost ring. This variation is entirely negligible, in terms of the behaviour of the strip 10a, for a material which is able to undergo elongation of up to 300%.

Finally, in order to ensure uniform and homogeneous transfer of the movement from the belt 6 to the rollers 3, the latter are preferably connected together, for example either by means of a series of short belts 12 which connect each roller 3 to the next one, or via a single peripheral belt when the perimeter to be embraced is small. These short belts 12 are preferably arranged on the upper portion of the rollers 3, underneath the drive belt 6. This arrangement also allows the movement to be transferred to the feed roller 3a, and hence to the pre-stretching unit, when the feed roller is located in the position illustrated in Fig. 5, i.e. at a position where it is not affected by the direct action of the belt 6.

To conclude, the wrapping machine for pallets as described fully achieves the objects of the invention, obtaining moreover a series of further advantages:

- the pulsating request of film, due to the irregular shape of the product, is compensated immediately by the epicycloidal system which is not affected by delays of any kind and does not require the use of complicated and costly compensation mechanisms such as the aforementioned jockey roller;

- the ability to keep the tension of the film constant, thus drastically reducing the possibility of accidental breakage, allows operation with a decidedly higher degree of pre-stretching compared to that commonly used in conventional pallet wrapping machines, allowing savings in material;

- the winding tension can be regulated from the outside by adjusting the braking system of the annular structure, also during operation of the pallet wrapping machine;

- the absence of concentrated rotating masses and the excellent compensation of the tension allow operation at higher rotational speeds, increasing the productivity;

- the absence of large rotating masses allows the entire machine to be designed with more streamlined dimensions, without affecting the safety, resulting in greater economy and easy assembly and maintenance;

- the accumulation of film on the perimeter of the annular structure results in the availability of film even after the bobbin has run out; this gives the operator a period of time, between running out of the bobbin and running out also of the strip of accumulated film, during which the pallet wrapping machine may continue operation normally, to intervene and replace the bobbin;

- the accumulated strip provides an excellent support onto which the terminal end of the used-up bobbin may be joined to the initial end of the new bobbin, the joining operation being able to be performed simply by

affixing of one end onto the other taking advantage of the adhesive properties of the extendable plastic material; in this way continuity is ensured between one bobbin and another one, completely eliminating the wastage of material following running out of the bobbin, both due to precautionary stoppage of the pallet wrapping machine and due to that portion of film wrapped only partially on the product;

- the arrangement of the bobbin externally of the annular structure allows replacement thereof even when the pallet wrapping machine is in operation, since the operator does not have to enter into the working zone: machine stoppage time is thus reduced to a minimum, coinciding substantially with the time necessary for joining together the two ends of film in the manner described above;

- the optimum arrangement of the bobbin also simplifies the design of an automatic bobbin-changing machine;

- the use of single motor for achieving both movement of the annular structure and driving of the pre-stretching unit without doubt constitutes an advantage in terms of cost;

- the constructional simplicity of the entire machine, due also to the fact that the electric motor is located outside the annular structure, i.e. fixed with respect to the bridge frame, and does not require complex power supply systems, reduces the manufacturing costs, improves the operational reliability and results in less complex maintenance.

Finally, the absence of components inside the annular structure N, which exist instead in the known art in the form of the bobbin support bracket with the associated pre-stretching unit, allows machine size to be reduced considerably.

This advantage may be readily demonstrated. For ordinary pallets with dimensions of 1200 x 1000, the internal diameter of the annular structure N shall be greater than about 1900 mm and its maximum dimension may be easily contained within 2300 mm, compared to the

2500 - 2600 mm of pallet wrapping machines constructed in accordance with the known art: this means that the entire machine may be loaded into the storage container of a lorry (width 2400 mm) without having to disassemble and reassemble the machine at its destination.

According to another embodiment of the invention, a pallet wrapping machine which is simplified compared to the one described above, i.e. in which the bobbin is mounted fixed to the annular support defined by the two circular rims 1 and 2 (Figs. 6 and 7), is provided. In this case, there is no longer a relative movement between the bobbin 9 and the rims which results in the film being wound gradually onto the external perimeter of the rollers 3. Therefore, in the absence of the accumulating function of these rollers 3, it is no longer necessary for them to have a length at least equivalent to the height of the film, but it is sufficient for them to have an adequate length for engagement with the short belts 12. Only the rollers 3a and 3b, forming part of the pre-stretching unit, and where applicable the transmission roller 11, have an extension such that they are able to guide the entire height of the film.

Preferably, as can be seen in Fig. 7, the bobbin is mounted entirely in cantilever fashion, projecting perpendicularly from one of the two annular rims, and likewise the rollers of the pre-stretching unit also project from the same side.

This solution involves an advantageous constructional simplification, which consists in a greater lightness of the annular structure and in a reduction in costs, even though it means having to dispense with some of the advantages described above, including the possibility of creating an accumulation of film, so as to allow more efficient changing of the bobbin, and the elimination of eccentric masses, so as to lighten the supporting structure.

In any case the effect of balancing and compensating the tension of the film owing to use of the epicycloidal structure, remains unaffected,

thus fulfilling the objects described in the preamble. Therefore, the manufacturer will retain the option of offering the purchaser the embodiment which is most suited to his requirements also in terms of a performance-versus-cost comparison.

It is understood, however, that the invention is not limited to the particular configurations illustrated above, which are merely non-limiting examples of the invention, but that numerous variants are possible, all within the capacity of a person skilled in the art, without thereby departing from the protective scope of the invention itself.

It should be pointed out that the scope of the invention may be extended also to other possible embodiments of the epicycloidal gearing developed for this specific application. For example, the driving belt 6 could be replaced by a crown gear which engages, internally, with the rollers provided with pinions and, externally, with a driving pinion made to rotate by the motor 8.

Finally, although a vertically extending pallet wrapping machine has been described, i.e. one in which the translation of the annular structure is performed vertically, the same principle may be applied to a pallet wrapping machine which winds the film turns along a horizontal axis. This latter solution is particularly suitable for those cases where it is intended to wrap small packs so as to obtain multiple-pack bundles.

CLAIMS

1. Wrapping machine for pallets of the type comprising a fixed frame (P) on which there is mounted an annular structure (N) surrounding a product (C) to be wrapped and translatable with respect thereto, a film (10) of plastic material being distributed around said product by the annular structure (N), characterized in that said annular structure comprises:

an annular support (1,2) rotating in its plane,

a set of rollers (3) rotatably mounted on parallel axes fixed to said annular support and distributed along a circular line, and

a driving element (6), which at least partly embraces the set of rollers (3) bearing on their periphery and which is operated by motor means (7) located externally with respect to said annular structure (N).

and in that said film (10) is fed from the outside of said annular structure (N) and, crossing said annular structure between two adjacent of said rollers (3), is dispensed internally by rotation of said annular structure, so as to be applied in turns on said product.

2. Wrapping machine for pallets of the type comprising a fixed frame (P) on which there is mounted an annular structure (N) surrounding a product (C) to be wrapped and translatable with respect thereto, a film (10) of plastic material being distributed around said product by the annular structure, characterized in that:

said annular structure (N) has a configuration in the form of an epicycloidal gearing in which the spider, the planetary gears and the driving gear consist, respectively, of an annular support (1,2), a set of rollers (3) rotatably mounted on parallel axes mounted on said annular support along a circular line, and a driving element (6) operated by motor means (7) and acting on said rollers (3).

and in that said film (10) is fed from the outside of said annular structure (N) and, crossing said annular structure between two adjacent of

said rollers (3), is dispensed internally by rotation of said annular structure, so as to be applied in turns on said product.

3. Wrapping machine for pallets as claimed in claim 1 or 2, wherein said driving element is an endless belt (6) and said motor means consist of a driving pulley (7).

4. Wrapping machine for pallets as claimed in claims 1), 2) or 3), wherein said film (10) is a film of extendable plastic material and wherein a pre-stretching unit (3a,3b)is also provided at the point where the film (10) crosses said annular structure (N9.

5. Wrapping machine for pallets as claimed in claim 4, wherein said pre-stretching unit comprises a primary roller (3a), coinciding with a roller of said set of rollers (3), and at least another secondary roller (3b), which are located at short distance from one another and are connected mechanically with a transmission ratio such that the secondary roller (3b) rotates at a faster speed than the primary roller (3a), said extendable film (10) undergoing elongation as it passes from the primary roller (3a) to the secondary roller (3b).

6. Wrapping machine for pallets as claimed in any one of claims 1 to 4, further comprising a braking system acting either on the annular support (1,2) or on the rollers (3).

7. Wrapping machine as claimed in any one of the preceding claims, wherein the annular support comprises a pair of parallel annular rims (1,2) between which the rollers (3) are rotatably mounted.

8. Wrapping machine for pallets as claimed in claim 7, wherein the braking system acts on at least one of said rims.

9. Wrapping machine for pallets as claimed in any one of the preceding claims, wherein said rollers (3) are rotationally synchronized by reciprocal connection means.

10. Wrapping machine for pallets as claimed in claim 9, wherein said reciprocal connection means are short belts (12) which connect each

other the rollers (3).

11. Wrapping machine for pallets as claimed in claim 10, wherein said endless driving belt (6) embraces said rollers (3) bearing on said short belts (12).

12. Wrapping machine for pallets as claimed in any one of the preceding claims, wherein said annular structure (N) is guided by a plurality of supporting wheels (5) distributed along its periphery and rotatably mounted on a translatable guiding frame (4).

13. Wrapping machine for pallets as claimed in claim 12, wherein the motor means (7) which operate the driving element (6) and a bobbin (9) supplying the film (10) are mounted externally with respect to the annular structure (N), on said guiding frame (4).

14. Wrapping machine for pallets as claimed in claim 13, wherein said rollers (3) have a length at least equal to the height of the film (10).

15. Wrapping machine for pallets as claimed in any one of claims 1 to 12, wherein the motor means (7), which operate the driving element (6), are mounted externally with respect to the annular structure (N) and a bobbin (9) supplying the film is mounted on said annular support.

16. Wrapping machine for pallets as claimed in claim 15, wherein the bobbin (9) is cantilevered mounted projecting from one side of said annular support (1,2) and only said rollers (3a,3b) forming the pre-stretching unit extend over a length at least equal to the height of the extendable film (10).

AMENDED CLAIMS
[received by the International Bureau on 2 February 1998 (02.02.98); original claim 4 amended ; remaining claims unchanged (1 page)]

said rollers (3), is dispensed internally by rotation of said annular structure, so as to be applied in turns on said product.

3. Wrapping machine for pallets as claimed in claim 1 or 2, wherein said driving element is an endless belt (6) and said motor means consist of a driving pulley (7).

4. Wrapping machine for pallets as claimed in claims 1), 2) or 3), wherein said film (10) is a film of extendable plastic material and wherein a pre-stretching unit (3a,3b)is also provided at the point where the film (10) crosses said annular structure (N).

5. Wrapping machine for pallets as claimed in claim 4, wherein said pre-stretching unit comprises a primary roller (3a), coinciding with a roller of said set of rollers (3), and at least another secondary roller (3b), which are located at short distance from one another and are connected mechanically with a transmission ratio such that the secondary roller (3b) rotates at a faster speed than the primary roller (3a), said extendable film (10) undergoing elongation as it passes from the primary roller (3a) to the secondary roller (3b).

6. Wrapping machine for pallets as claimed in any one of claims 1 to 4, further comprising a braking system acting either on the annular support (1,2) or on the rollers (3).

7. Wrapping machine as claimed in any one of the preceding claims, wherein the annular support comprises a pair of parallel annular rims (1,2) between which the rollers (3) are rotatably mounted.

8. Wrapping machine for pallets as claimed in claim 7, wherein the braking system acts on at least one of said rims.

9. Wrapping machine for pallets as claimed in any one of the preceding claims, wherein said rollers (3) are rotationally synchronized by reciprocal connection means.

10. Wrapping machine for pallets as claimed in claim 9, wherein said reciprocal connection means are short belts (12) which connect each

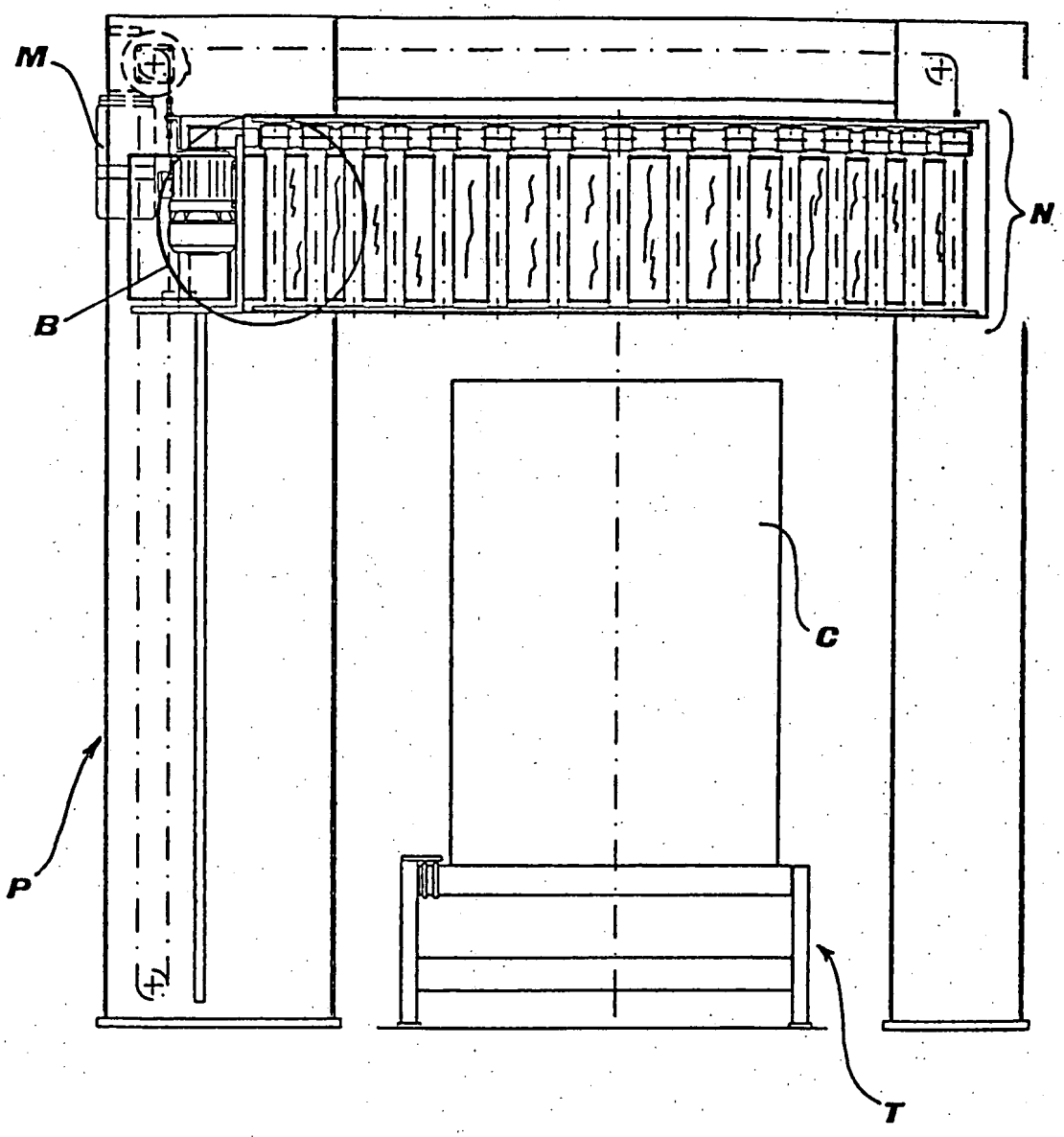

Fig.1

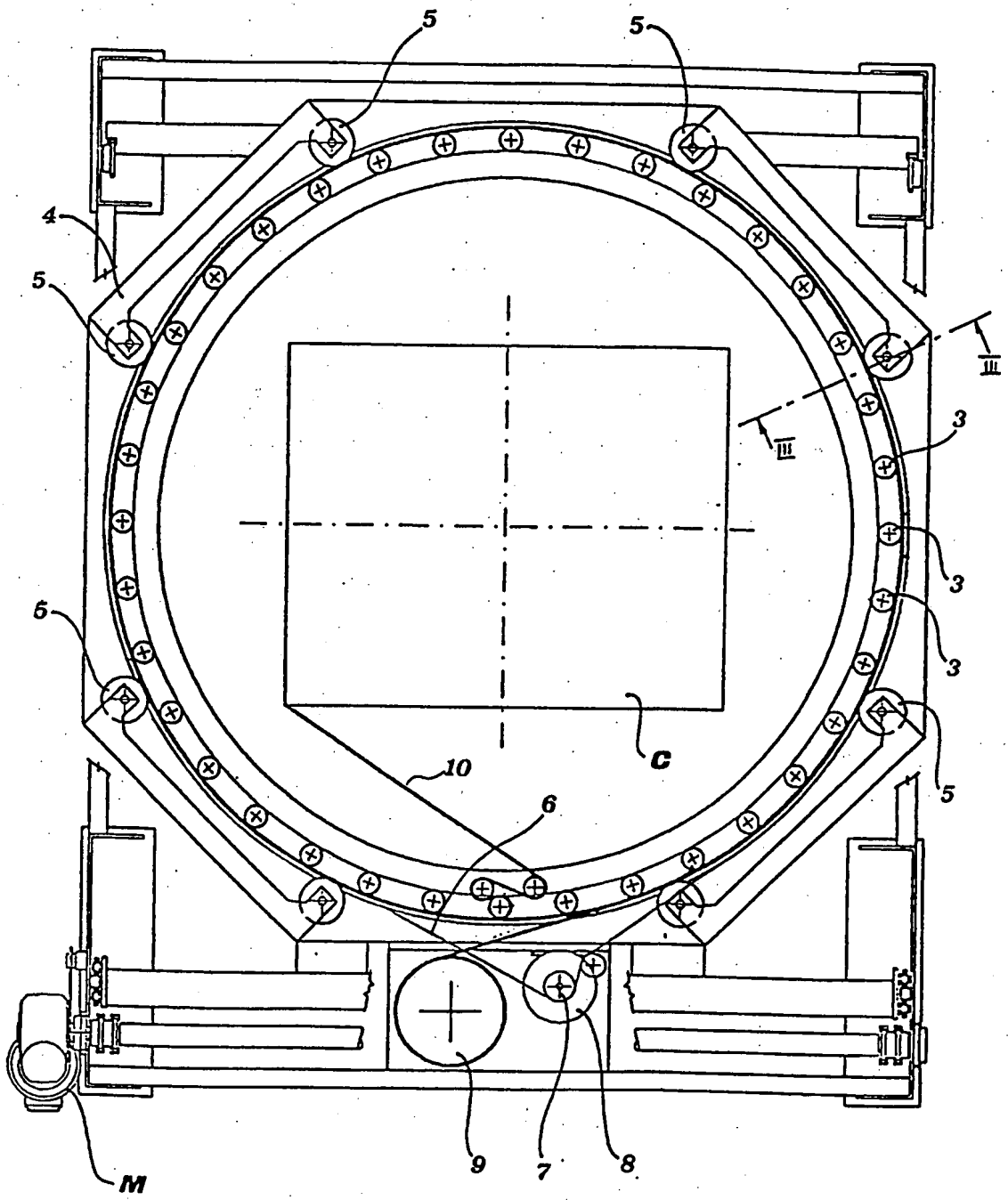

Fig.2

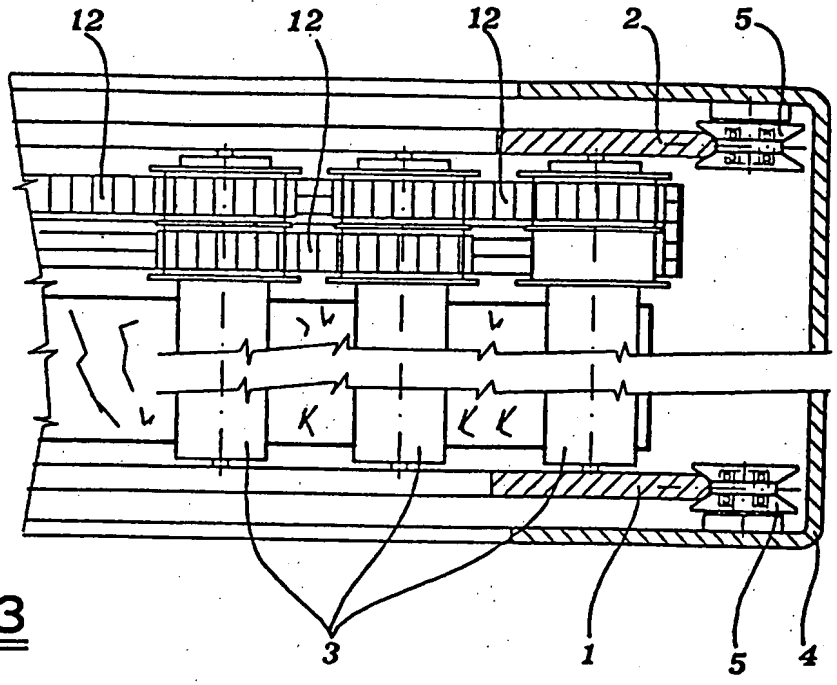

Fig.3

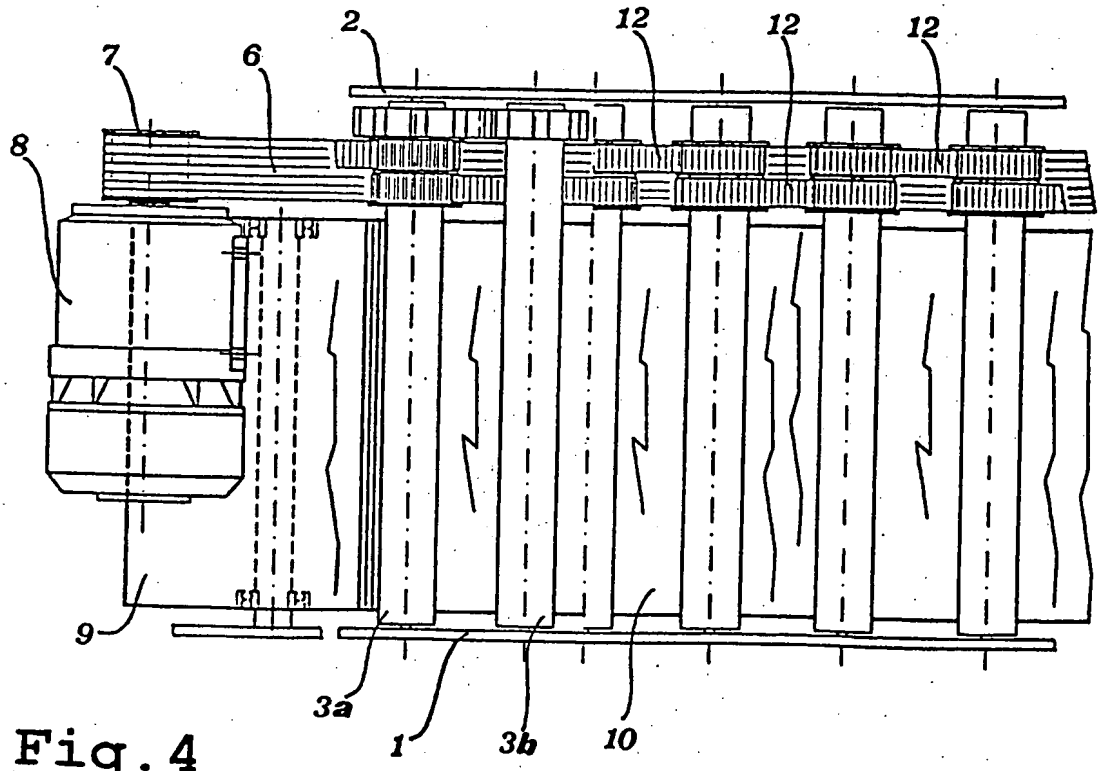

Fig.4

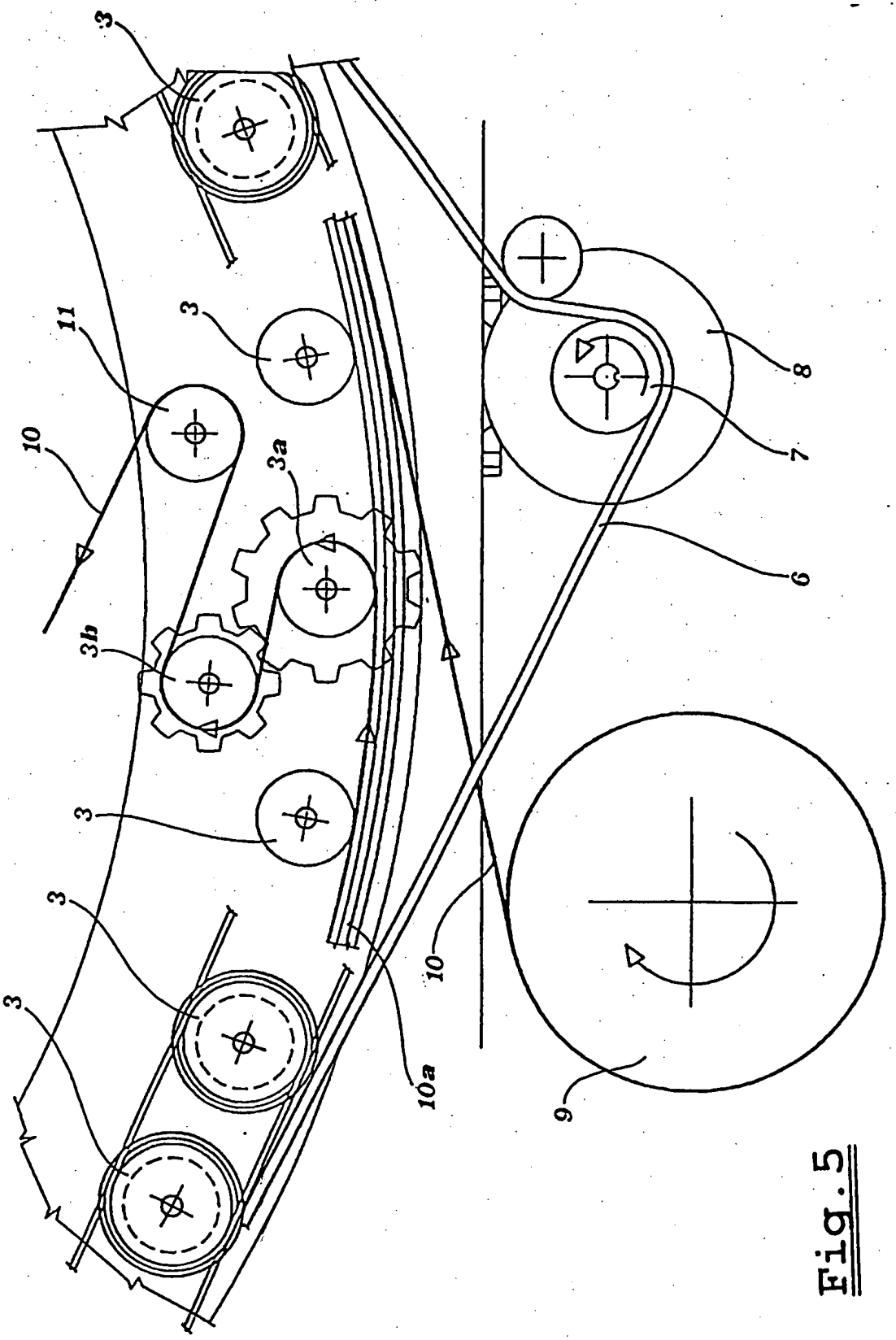

Fig.5

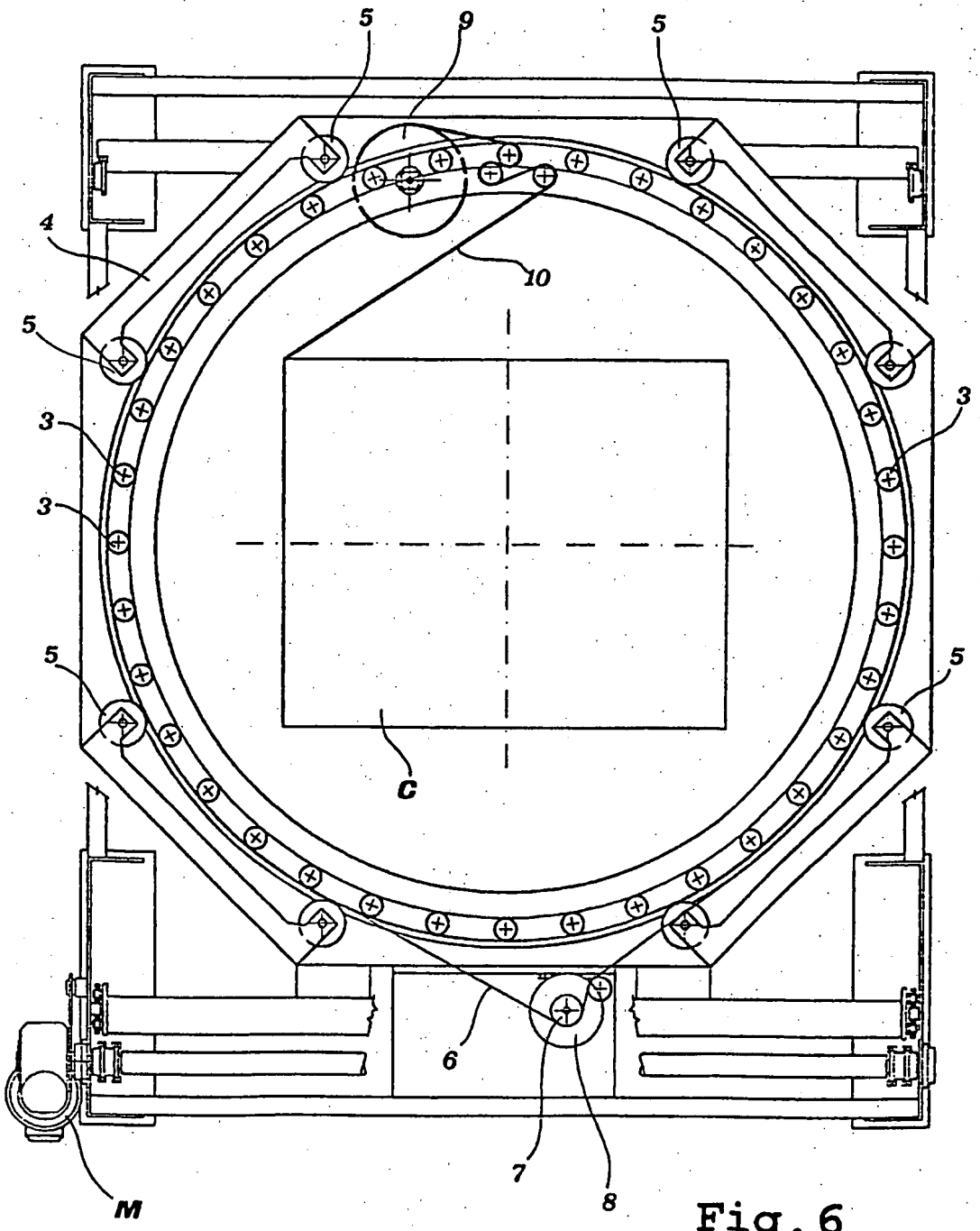

Fig. 6

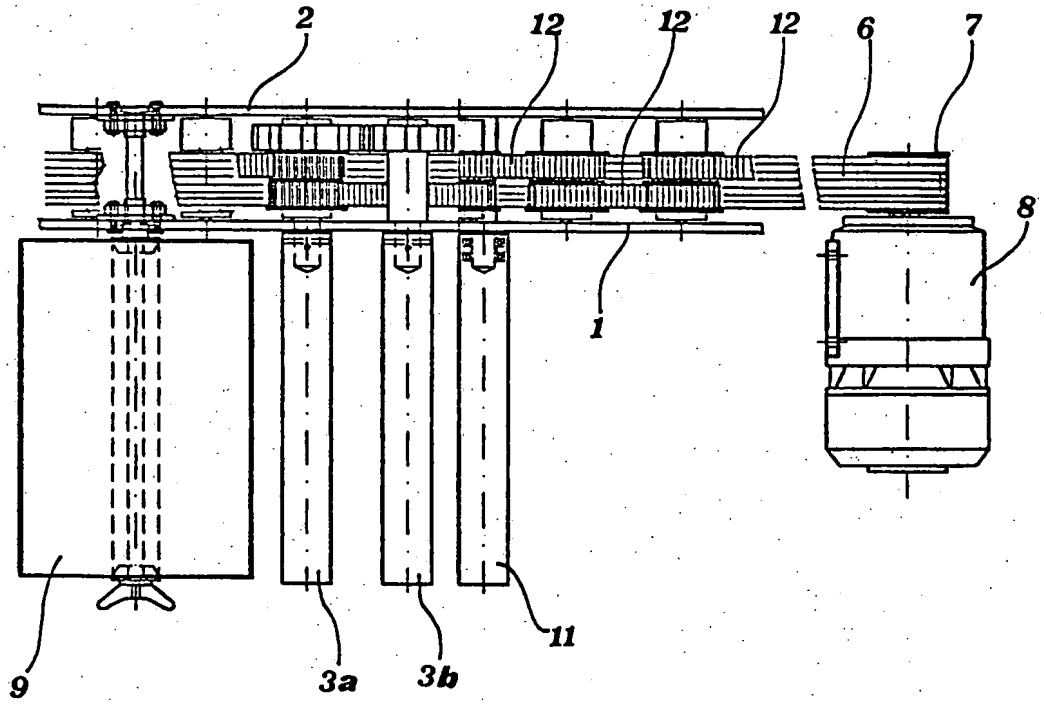

Fig.7

INTERNATIONAL SEARCH REPORT

Inte 'onal Application No
PC1/EP 97/03628

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B65B11/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B65B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 027 581 A (HAYSSEN) 2 July 1991 see column 4, paragraph 2; figures 1,2,4,4A,6	1-5,12, 15
A	EP 0 369 233 A (POLONI) 23 May 1990 see the whole document	1,2
A	US 2 749 837 A (HAYFORD) 12 June 1956	
A	GB 670 737 A (CRANSTON) 23 April 1952	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

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1

Date of the actual completion of the international search	Date of mailing of the international search report
11 November 1997	18/11/1997

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Claeys, H

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INTERNATIONAL SEARCH REPORT

.formation on patent family members

Inter onal Application No
PC1/EP 97/03628

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